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Children working in the Sericulture industry :

A Research Study on Respiratory Morbidity & General Health Status

MAYA

2003

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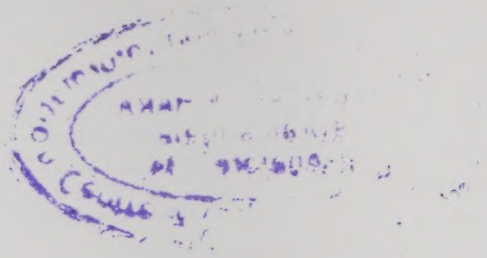

Children working in the Sericulture Industry:

Respiratory Morbidity and General Health status

An Exploratory Research Study

Initiated & supported by

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Foreword

This is a research study that seeks to build on MAYA's experiences over the last 5 years, of working with children and communities in the region of Ramanagaram taluka of Bangalore Rural district, towards the eradication of child labour in the sericulture industry in Karnataka.

The study examines the organisation's premise of the detrimental impact of the sericulture industry, particularly the filature (silk-reeling) units, not only on those working therein but also on the overall health status of the area. The need for such a detailed health research study also came as an effort to further substantiate observations made in an earlier publication- "Which Silk route this? - a situational analysis of child labour in the sericulture industry of Karnataka".

This research study was conducted, analysed and collated by a joint team of doctors, medical researchers and development facilitators from St John's Medical College & Hospital, Bangalore, St Martha's Hospital Bangalore, Community Health Cell and MAYA. The study derives its strength from the communities that MAYA works with- their experiences, perceptions, belief and understanding.

MAYA would also like to acknowledge with appreciation the Royal Norwegian Embassy for its support.

Bangalore

Jun 2003

The investigating team shares,

The opportunity to undertake an academic exercise and study a scientific question with regard to the association of a known allergen and a study population of children working in the sericulture industry held immense potential. We took pride in the development of a good academic study protocol, the pilot study, its implementation and the analysis. This was a challenge for this unusual collaboration between a clinical department (Paediatrics) of a teaching hospital, MAYA a development organisation and Community Health Cell an NGO partner in the process. This unique endeavour brought academic research down to earth during the struggles to make perfect a scientific study in the realistic world of rural India with all its multiple confounding factors. This study has not only been a scientific revelation to us, but a learning exercise to all partners involved to be shared with all similar collaborators attempting such an exercise. We are all happy to have been a part of this study and hope the data generated can be utilised for the improvement in child health.

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Contents

Introduction 1-3

An introduction to the organisation, the purpose of the study and a background of child labour in sericulture.

Research Design 4-7

The design, methodology, process and assumptions of the research study.

Findings 8-12

A detailed description of the findings of the study

Reflections 13

A summing up of the study in terms of implications for future action

References 14

Studies and articles referred to understand other perspectives and experiences on the issue.

Appendix 15-17

A copy of the forms utilised in the study as well as a discussion of the findings of this study in comparison with similar studies.

Introduction

MAYA

As a development organisation working since 1989 towards the eradication of child labour, MAYA's approach emphasises addressing structural dimensions of the issue. In this regard, MAYA works towards building institutional capacities of communities in order that they are able to assume responsibility for issues affecting their lives. Such an approach is envisaged to engage the communities in a process not only to address issues concerning children's rights in the local area but also to become an important voice to articulate policy agendas.

Over the years, in addition to an enhanced understanding of issues *(communities, education, livelihood, etc)* and initiating interventions at the systemic level, MAYA has also begun to develop its potential in terms of influencing policy and practice through evolving working models. Empirical information to indicate the impact and scope of these working models is documented and made available for sharing with interested groups and individuals.

MAYA has been working in the sericulture region of Ramanagaram and Channapatna talukas of Bangalore Rural district since 1998 with the primary focus of eradication of child labour in the sericulture sector. The high incidence of child labour in the sericulture industry and the absence of any other organisation working on the issue in these areas, were deciding factors in MAYA getting involved. The organisation's work in these areas has focussed on interacting with parents and community members, improving the quality of local Govt schools, relieving children from work in the filature units and enrolling them back to formal school.

In the light of the State's recent promotion of the sericulture industry as a large-scale income-generating opportunity, MAYA sees an urgent need to draw attention to the high prevalence of children working in this industry and the extremely unhygienic and hazardous conditions that dominate the silk-reeling units. In this regard, it perceived the importance of conducting a scientific study on the adverse effects on the health of children working in filature units.

Silk-reeling and filature units

Mulberry sericulture consists of rearing the silkworms in a controlled temperature and humidity environment using harvested mulberry leaves. The life cycle of the silkworm ranges from 25-30 days through which the eggs reach the stage of cocoons.

Dried cocoons are turned into yarn through a process called *"reeling"*. The silkworm spins the cocoon by spitting out the silk fluid through a spinnerel at its mouth and this fluid hardens to form a fine silk filament (*bave*) on coming into contact with the air. This comprises two distinct filaments composed of fibroin, stuck together and covered by silk-gum or sericin. When the cocoons are treated with hot water the gum (sericin) being readily soluble in hot water readily facilitates the unwinding process. This operation of unwinding the silk filament from the cocoon is called reeling. The silk-reeling consists of essentially two operation, i.e. cooking the cocoons to separate the thread from the cocoon and combining 8-12 single threads into a single yarn on to a reel. Silk reeling is predominantly a cottage industry.

The two principal techniques in this small-scale industry are

(a) the *traditional manual charaka method* existing in Karnataka since the last 200 years. Here, cocoons are cooked in a simple kettle over charcoal and the cocoons fed manually to large manually operated 'charakas' connected to cycle wheels fitted with ball bearings, driven by a chain and a manual turning mechanism. Sometimes, the charakas are directly driven through a large wheel operated by hand with/without ball bearings.

(b) the *semi-mechanised technique of using cottage basins*:
Cottage basin reeling involves reeling the cocoons in hand operated cottage basins, mostly of smaller size and with one or two tables (i.e. two to four basins) operated by a single turner.

The commonly used reeling units, referred to as *'filature'* units have the cooking unit physically at a distance from the basin where the cooked basin has to be shifted from the cooking vessel to the reeling basin from time to time, an activity done mostly by children.

Ramanagaram, the study area

Situated 48 km from Bangalore on the Bangalore-Mysore highway in a valley surrounded by rocky hillocks, Ramanagaram taluka with its 135 villages, forms a significant part of Karnataka's silk-belt. The cocoon market in Ramanagaram town is the largest in Asia and has an average daily transaction of 30 tonnes. The town has a population of 79,382 persons, with almost 1000 child labourers in the sericulture industry, 2138 reelers, 915 charkhas, 1500 filature units and 102 grainage units (data collected from various sources).

For the purpose of this research study, children were identified from the areas of Rahamania Nagar, Tippu Nagar, Phoolbagh, Mahboob Nagar, Ghousia Mohalla, Balgere, Nagankatte, Kaisoppanbeedhi, Arkeshwara Colony and Janatha colony.

Malvalli, the control area

Malvalli is a taluka in Mandya district about 50 km away from Ramanagaram, on the way to Mysore. The town is smaller than Ramanagaram and has 2 filature units, 13 Charkhas and 3 grainage units.

Apart from the relatively insignificant number of filature units and grainage units in Malvalli, it was found that majority of the workers at the filature units belonged to families who had migrated from Ramanagaram; only a very small percentage of the local residents worked in the filature units. Furthermore, children were not found to be employed in the units.

Children were identified from the areas of Masjid mohalla, Paint beedhi, Gangamata beedhi, Devanga beedhi and Besthara beedhi for the research study.

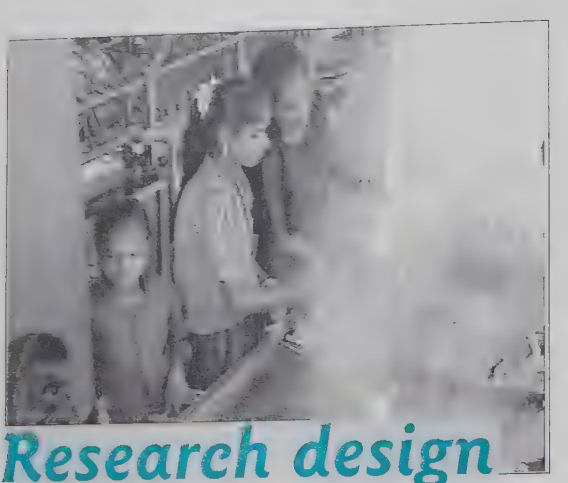
Sericulture & Child labour

Karnataka contributes to nearly 60% of the country's total mulberry silk production {*as per statistics obtained from Central Silk Board*}. Children are employed in all the different stages of silk processing, particularly the post cocoon stage. It is estimated that between 60,000 to 100,000 children work in Karnataka's silk industry, thereby making it a child-based industry. About 80% of the individuals involved in reeling silk are between the ages of 10-15 years [Human Rights Watch report, 1999]. Within the filature unit, children are usually involved in the tasks of cooking, during which the silkworms emit a protein called sericin in the form of foul-smelling vapours that pervade not only the silk units but also the entire region surrounding the units. It is this protein vapour that has been attributed to cause chronic bronchitis and asthma.

The number of studies on occupational health among children in this industry is almost non-existent. An earlier study among adults reported that 16.9% of the total subjects from sericulture industry could be clinically categorised as having occupational asthma free from symptoms while away from work, with exacerbations upon resumption of occupation. At least 21.8% of the persons employed in silk filatures responded positively to both cocoon and pupal allergens [2]. Studies have shown that children develop sensitisation to indoor allergens as they grow older in that atmosphere. Sensitivity of 1.5% at 1 yr age increases to 90% at 8-11 yrs of age [3].

It is believed that in the sericulture sector, the child grows up working at the cost of its health, education, and social opportunities. Recent epidemiological studies of naturally occurring and occupational asthma have shown the importance of allergic factors in the pathogenesis.

The research question this study set out to answer was "*Is the prevalence of health problems (especially respiratory morbidity) more in children working in the filature units of sericulture industries at Ramanagaram town as compared to the children who are not working in filature units?*" The findings of this study would be utilised to strengthen policy and practice vis-à-vis eradication of child labour in sericulture.



Research design

Objectives

The primary objective was to study the comparative prevalence of Respiratory morbidity especially Hyperactive Airways among children working in filature units. The secondary objective was to study the comparative general health status among children working in the filature units.

Hyper reactive airways commonly referred to as asthma, relates to a condition where the air passage in response to a number of triggers (risk factors) becomes inflamed and blocked by constriction. This is characterised by recurrent episodes of all or either of these symptoms- wheezing, breathlessness, chest tightness, and coughing, particularly at night or early morning. The magnitude of response differs from one individual to the other.

Peak expiratory flow rate (PEFR) A measurement of the maximum volume of air that a person can forcibly exhale after taking the deepest breath possible. This can be measured by exhaling (blowing) through a peak flow meter.

Methodology

Design

The study was designed as a cross-sectional (prevalence) study of environmental conditions at work/home and the presence of clinical evidence of health problems with special reference to hyper reactive airways as determined by symptoms and peak expiratory flow rates. The definition of 'exposure' in the study was children working in filature units for at least 3 months and definition of 'control' (non-exposed) was school children not working in filature units.

Study Groups

The study population was divided into three groups:

Group I included children working in the filature unit of the local sericulture industry at Ramanagaram for at least 3 months;

Group II included controls from among neighbours at home not working in a similar allergen industry (internal controls) in Ramanagaram; and,

Group III included children from Malvalli not exposed to a similar environment (external control).

The significant difference in the number of functioning units in the two towns of Ramanagaram and Malvalli appeared to permit a comparison between these different groups - exposed, internal non-exposed (internal control group) in Ramanagaram and external non-exposed (external control group) in Malvalli.

Sample Size

The research study worked with a sample size of 279 children working in the filature units. This was ensured on the basis of a known incidence of 4-5% and an expected incidence of

20-25% of hyper reactive airways and included consecutive sampling of children of consenting parents. In each of the control groups from the home locality (Ramanagaram) and the identified external control (Malvalli), a minimum of 100 children were examined on a similar basis.

Questionnaire

The questionnaire used in the research study was a modification of the (i)subjective ISAAC *(International Study of Asthma and Allergies in Childhood)* questionnaire and a Bangladesh questionnaire (ISAAC Lancet 1985, Hassan et al International Journal of Epidemiology, 2002) and factors associated with asthma as described by Parmesh (Indian Journal of Paediatrics, 2002) along with (ii)an objective physician clinical examination similar to that utilised in clinics to suspect and diagnose children with respiratory disease especially hyper reactive airways.

Inclusion/Exclusion Criteria

The inclusion criteria was all children aged above 5 yrs and upto 18 years, who have worked for more than 3 months in the filature units of the sericulture industry at Ramanagaram town as the exposed group. Exclusion criteria were those who were acutely ill; asymptomatic but unable to perform peak flows satisfactorily; and, those who did not consent.

Methods

Initially, training for standardisation of data collection *(demographic, symptoms, environmental factors)* and measurements *(clinical, peak flow rates before and after inhaled broncho-dilator, silk skin test)* was conducted for the field investigators.

The services of a local Rotary Hospital were utilised for baseline blood investigations, skin testing, education and medication. Facilitators from MAYA interacted with parents of the identified children, discussed the purpose of the research study and obtained a written informed consent for examination and testing (in the local vernacular- Urdu & Kannada).

A clinical history of every child, including symptoms and environmental factors, with specific reference to hyper reactive airways was documented.

A detailed medical examination was conducted that included

- anthropometry,
- PEFR before and 20 mins after two beta agonist (Salbutamol) inhalations using a standard spacer device and
- a silk skin test.

Blood samples (Hb, TC, DC and ESR) were collected in open vials for manual counts by technicians in the local Rotary Hospital.

Duration

The study began in Ramanagaram with a 2-day pilot study on 12th December 2002 and concluded on 9th Jan 2003 in Malvalli.

Outcome variables

The clinical endpoints in this study were predominantly respiratory symptoms in view of the nature of the occupation under scrutiny. Hyperreactive airways would be clinically suspected if a child presents symptoms of recurrent episodes of night cough, wheeze, fast breathing or chest retractions in isolation or in combination with the examination finding of rhonchi *(a snoring noise)*.

The production of sputum (phlegm) and cough in a child could indicate episodes of bronchitis, while those with recurrent coryza *(inflammation of mucous membrane lining the nose)*, running nose, nose blocks, sneezing could have allergic rhinitis. The presence of non-painful itching eyes with redness and watering would point to allergic conjunctivitis. All these conditions would be health problems probably attributed due to occupational effects of working in filature units.

In view of the field study conditions, PEFR [5] was selected as an objective assessment for airways hyper reactivity. A onetime PEFR variability of >15% was taken as significant objective evidence of bronchial hyper reactivity before and after inhaled beta-agonist.

The outcome variables were hence defined as follows: Hyper reactive airways disease was suggested by episodes of wheeze, cough, fast breathing, chest retractions, night cough and/or rhonchi. Allergic symptoms of frequent colds and sneezing; red eyes with itching and watering and no pain; itching skin rash were defined for the questionnaire.

Skin Test

A silk skin test was compared with a saline and a histamine skin test, to attribute any allergic manifestation to the silk utilised in the industry. 0.1 ml each of silk antigen, Histamine (released by cells in response to an allergic reaction) and Normal saline was placed on the volar surface of the forearm. A skin prick test was carried out on all three drops on the arm. The skin reaction of silk antigen was read after 15 minutes by comparing with Histamine and Normal saline, which served as positive and negative controls, respectively. The interpretation of positive reaction to silk antigen was based on comparative size of wheal formation at the site of skin prick test. If wheal formed by silk antigen was equal to or more than wheal produced by the histamine it was taken to be positive. The test was performed by a single observer (one of the investigating doctors) to avoid inter-observer variability.

For a silk skin test, the allergen extract is obtained from silkworm pupae that are separated from cocoons, immersed in liquid nitrogen and crushed into a fine powder. Water is added to the powder till it forms a slurry and squeezed through a two-layered muslin cloth. 4 volumes of chilled acetone are added to 1 volume of the extract and after stirring, the mixture is filtered through Whatman No. 3 filter paper under suction. The residue is washed several times with chilled acetone and finally with chilled peroxide-free diethyl ether. The resultant powder is dried and kept at 20°C for further use. For use, the acetone-dried powder of pupae is stirred for 2 hrs at room temperature with 20 ml of 100mg sodium phosphate buffered saline, pH 7.4. The slurry is centrifuged at 20,000xg for 15 minutes. The crude extract thus obtained (1:20 wt/vol) is filter sterilized and used for prick skin tests after diluting with an equal volume of sterile glycerin to give a 1:40 wt/vol.

Statistical Analysis

Data collected was independently analysed using EPI Info -6 and the probability calculated. Differences between the groups were considered statistically significant if the probability value was < 0.05.

Ethics

The study included a Subject Information Form and Informed Consent form in the local language; confidentiality of all data was maintained. The study was cleared by the Institution Ethical Review Board of St. John's Medical College & Hospital.

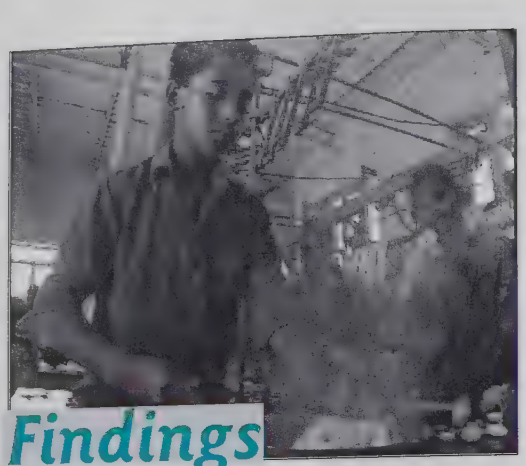
Experiences of the study design and process

During the study, there was an apparent break in the randomisation and stratified selection process. A primary reason being that since this was a community-based occupational health study, the concept of randomisation (in terms of some children being identified and others left out) was not easily understood by the parents in the areas. Furthermore, the lack of adequate exposure of the community to such health studies and medical tests was responsible for the spreading of non-specific rumours and fear regarding such tests. Though these aspects were sufficiently discussed at the initial meetings and interactions with parents, they did have a minimal effect on the study in terms of permitting more than the identified children to be screened to avoid the felt 'discrimination'.

As envisaged for the study, a comparison was to be made between working children (exposed) and neighbourhood control children (unexposed). A neighbourhood control child in the study was clearly a school going child residing in neighbouring house of a working child in the random sampling list (age and sex matched). This was accurately identified, as per the criteria laid down in the protocol. During the study, it was discovered that some of the neighbourhood control children had worked in the filature units in the past or during their school vacations. There was thus a need to obtain a non-neighbourhood control study population clearly distinct in terms of exposure. It was decided to explore other areas as the original control would now be an opportunity to study partially exposed children. An inquiry into the history of the neighbouring Channapatna town revealed that silk processing was a major activity until two years ago. Subsequently, Malvalli in Mandya taluka was identified as a control area to be studied. Malvalli was selected for its similarity in terms of socio-economic conditions, and a negligible presence of filature units.

In both Ramanagaram and Malvalli, the services of a local hospital were utilised. This was primarily to fulfil the need of a local health set-up as a safety precaution for the skin testing and any other adverse effect. This was also decided after taking into consideration the logistics of transporting the blood samples (in vacuutainers) during the working hours of Bangalore hospitals. In Malvalli, a local NGO, also assisted the team in arranging logistics.

Informal assistance was sought from local governmental institutes in the treatment for anaemia. Iron and Albendazole tablets were supplied for all the study children who showed anaemia.



Findings

The identified parameters suggestive of hyper reactive airways disease, bronchitis and allergic rhinitis were found to be most prevalent among children working in the filature units at Ramanagaram as compared to both internal and external controls(in Ramanagaram and Malvalli respectively). Except for the recurrent cough among working children at Ramanagaram, no other parameter was statistically significantly different when compared to the non-workers in Ramanagaram.

When the working children at Ramanagaram were compared with the non working children from Malvalli, there was statistical significant difference among the groups and their prevalence of allergic manifestations. However, the objective eosinophil counts, PEFR variability and Silk antigen testing did not differ between the groups. Moderately severe anaemia (Hb < 10 gm/dl) was the commonest health problem with > 78% of all children needing treatment and advice. Children > 10 years showed a reduction in expected heights and weights progressively worsening with age. Vitamin B complex deficiency was significantly more common in the Ramanagaram population compared to Malvalli (9% versus 2%).

The analysis of factors responsible for the higher frequency of allergic symptoms among children in Ramanagaram to those in Malvalli points towards an environmental factor in Ramanagaram that differentiates it from Malvalli; It is believed that a major factor in this regard could be the number of silk units in the Ramanagaram region. This study also suggests that the health hazards due to an allergen industry such as sericulture have a far wider impact - going beyond the individual, to the environment affecting the entire community. A total of 401 children were selected from Ramanagaram (279:122 workers: non-workers; 192:209 male: female) and 142 from Malvalli (all non workers; 71:71 male: female).

For a comparison of the findings of this study with other studies conducted on the issue, see Appendix.

Symptoms

In all those children with symptoms of hyper reactive airways disease, those working in the filature units of Ramanagaram were found to be more frequently affected than those non working but residing in Ramanagaram. The results did reveal that there was a significant difference between working children from Ramanagaram and the external control group from Malvalli.

Respiratory morbidity

These symptoms suggest that children working in the filature units show higher proportion of respiratory problems when compared to non-working children both in Ramanagaram and Malvalli. Bronchial hyper reactivity was significantly increased in the study population of working children at Ramanagaram in

Table 1:Clinical outcomes of research study

Sno	Symptoms	Working(*Ramanagaram*)	Control(*Ramanagaram*)	Control (*Malvalli*)	Statistical Significance
1	Recurrent Wheeze	13.3% (37/279)	7.4%(9/122)	2.2%(3/136)	RCp=.09 MC p=<0.01
2	Recurrent Fast Breath	14.0%(39/279)	8.3%(10/121)	2.9%(4/136)	RC p=0.11 MC p=<0.01
3	Recurrent chest retraction	14.7%(41/279)	11.5%(14/122)	5.1%(7/136)	RC p= 0.38 MCp=<0.01
4	Recurrent Cough	31.5%(88/279)	20.5%(25/122)	4.4%(6/136)	RC p=0.02 MC p<0.01
5	Recurrent Phlegm	19.4%(54/279)	9%(11/122)	2.2%(3/136)	RC p=<0.01 MC p=<0.01
6	Recurrent Night Cough	21.6%(60/278)	15.7%(19/121)	2.3%(3/136)	RC p=0.17 MC p=<0.01
7	Frequent colds, sneeze,	35%(97/277)	27.3%(33/121)	16.9%(23/136)	RC p=0.13 MC p=<0.01
8	Recurrent Eye red/itch/water	15.8%(44/278)	9%(11/122)	5.9%(8/136)	RC p=<0.06 MC p=<0.01
9	Recurrent Itching skin rash	13%(36/278)	9%(11/122)	3.7%(5/136)	RC p=<0.27 MC p=<0.01
10	Recurrent Oozing Skin	8.9%(25/279)	2.5%(3/122)	0.7%(1/136)	RC p=0.02 MC p=<0.01
11	Hospital admission for any of above problems	7.2%(20/279)	6.6%(8/122)	2.9%(4/136)	RC p=0.8 MC p=0.08
12	PEFR cut off 15%	20.0%(54/270)	24%(27/114)	20%(21/105)	RC p=0.32 MC p=0.84
13	Silk antigen +ve	33.1%(92/278)	29.17%(35/120)	27.9%(26/93)	RC p=0.91 MC p=0.57
14	Clinically defined hyper reactive airways *(presence of Wheeze, fast breathing, chest retraction, cough, rhonchi, chest retraction)*	53.4%(149/279)	41.8%(51/122)	19%(27/142)	RC p=0.042 MC p=<0.01

RC indicates difference between Ramanagaram working and control;MC indicates difference between Ramanagaram working and Malvalli control. Statistical significance is taken to be significant if <0.05.

...contd

Table 1:Clinical outcomes of research study

Sno	Symptoms	Working(*Ramanagaram*)	Control(*Ramanagaram*)	Control (*Malvalli*)	Statistical Significance
15	Family history of asthma	25.9% (72/278)	23.7%(29/122)	11.8%(16/136)	RC p=0.65 MC p=<0.1
16	Pallor	73% (219/279)	73%(90/122)	69%(98/142)	No significant difference
17	Eosinophils	3.96% (n=250)	4.5%(N=114)	3.5%(n=127)	Normal range 1-6%
18	Haemoglobin Count				
	Hb=<8 gm%	13.6% (37/272)	16.1%(19/118)	16.7%(22/132)	
	Hb=8-10 gm%	65.8% (179/272)	66.9%(79/118)	76.5%(101/132)	
	Hb=10-12 gm%	20.8% (56/272)	16.9%(20/118)	6.8%(9/132)	
19 a	NCHS 6-10 yrs				
	Mean Ht (SD) cms	132.3 (10.3)n=37	122.9 (7.2)(n=57)	122.4(9.9)(n=51)	5^{th}-95^{th} Percentile 107-148cm
	Mean Wt (SD) kg	23.9(3.2) n=38	20.3 (3)(n=58)	20.4(4)(n=51)	5^{th} 95^{th} Percentile 17-45 kg
19b	NCHS 10-12 yrs				
	Mean Ht (SD)cms	122.9 (7.2)(n=57)	138.7 (9.8)(n=52)	135.6(5.5)(n=67)	5^{th}-95^{th} Percentile 127-162 cm
	Mean wt (SD) kg	20.3 (3)(n=58)	27.6 (5.9)(n=58)	26.9(3.7)(n=68)	5^{th} -95^{th} Percentile 24-58 kg
19c	NCHS 12-14yrs				
	Mean Ht (SD)cms	138.7 (9.8)(n=52)	143(8.4)(n=10)	142.6(6.4)(N=18)	5^{th}-95^{th}Percentile 137-177cm
	Mean wt (SD)kg	27.6 (5.9)(N=58)	29.05 (6.3)(n=10)	30 (3.8)(n=18)	5^{th} 95^{th} Percentile 30-72 kg
20	Vitamin B Deficiency	9.6%(27/279)	7.3%(9/122)	2.3%(3/142)	RC=0.45 MC=0.04

RC indicates difference between Ramanagaram working and control;MC indicates difference between Ramanagaram working and Malvalli control. Statistical significance is taken to be significant if <0.05.

comparison to those from the external control at Malvalli. The difference between Ramanagaram working and non-working children was not statistically significant.

Allergy

Allergic symptoms pertaining to upper respiratory tract, allergic bronchitis, skin rash were prominent in the study. The results suggest a significant difference of increased allergic symptoms *(allergic rhinitis, conjunctivitis, bronchitis, atopic skins lesions)* among working children living in Ramanagaram versus those in Malvalli. Among all the children with symptoms, those working in the filature units of Ramanagaram were more frequently affected than non-filature workers of Ramanagaram, though apart from recurrent oozing skin lesions the results were not statistically significant between these groups.

Hyper reactive airways disease

The distinctive characteristic of asthma has always been the concept of reversible airway obstruction. PEFR appeared similar in all groups working/non-working in Ramanagaram and those in Malvalli(20%, 24%, 20% respectively). It is possible that a single PEFR variability exercise has its limitations in the detection of hyper reactive airways and that a comparison with a personal best, *(not possible with a cross sectional study)* in the set-up would be needed to objectively clarify the presence of hyper reactive airways. An intermittent asthma or hyper reactivity rather than a persistent state could also be reason for the lack of differences between PEFR variability of groups.

Asthma presentation in children is varied; thus determining asthma by a single parameter may not be correct. In the context of the present study, when symptoms suggestive of asthma are taken in combination (wheeze, chest retraction, fast breathing, night cough and clinical findings of rhonchi and chest retraction) for clinical definition of hyper reactive airways, Ramanagaram working children had statistically significant higher proportion (53%) when compared to control children both in Ramanagaram (41% OR 1.6 $P=0.042$) and Malvalli (9% OR=4.86, $P=<0.01$) respectively. It is obvious that the longer the duration of exposure the more likely is the manifestations of asthma. This also implies that children may not objectively manifest the effects of the exposure to the allergen early and only after years of exposure would permit documentation of the disorder during adulthood. It is known that many workers of sericulture start working in childhood and could be afflicted with asthma by their early twenties causing disability and degrading the quality of life.

Skin Tests

The skin test is an independent predictor of asthma and the association becomes stronger with the addition of raised eosinophil counts and history of a parasitic disease. The skin prick antigen testing noted that 1/3rd of working children in Ramanagaram (33%) showed sensitisation, Similarly a high proportion of sensitisation was seen among the controls (29% in Ramanagaram and 28% in Malvalli). The high sensitisation in Malvalli control group could not be explained only by the very small number of silk units in Malvalli; the possibility of cross reactivity to other allergens such as moths will have to be looked into. All these possible explanations can only be proved by more elaborate longitudinal immunological studies. The detection of allergen-specific IgE(serum Immunoglobulins) could provide good supplementary data in future studies

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with regard to the specific nature of the allergen causing the problems.

Ramanagaram versus Malvalli

It now appears that the entire study population in Ramanagaram had similar features, irrespective of work or no work in filature units and they significantly differed by being more frequent than the group from Malvalli. One possible explanation would be, the allergens causing the allergic respiratory manifestations seen in Ramanagaram appear to be widespread in the environment. If silk as a known antigen is one such allergen, it could be postulated that the silk industry being the major allergen industry in the area of Ramanagaram it is too extensive in the environment to show a significant difference among children actually working and not working in filature units. Malvalli on the other hand with far less numbers of silk units had lower respiratory morbidity as compared to study groups of Ramanagaram. In addition, the pre-existing exposure to atopy may constitute an increased risk factor for asthma caused by occupational hazards in Ramanagaram, when compared with Malvalli.

General Health Indicators

General health indicators documented indicate that the entire study population, irrespective of residence or work, were anaemic. Working children of Ramanagaram show a significantly higher proportion of Vitamin B deficiency than control children in Ramanagaram as well as Malvalli ($p<0.05$). Physical growth as measured by height and weight remained on an average between the 5th and 95th percentile of NCHS standards.

Table II: Baseline influencing external factors

External factors	*Ramanagaram Workers*	*Ramanagaram non-workers*	*Malvalli non-workers*
Use of agarbathi (incense sticks)	87.8% 245/279	89.3% 109/22	46.5% 66/142
Gas, cooking fuel	0.0% 0/275	3.4% 4/118	8.6% 11/128
Kerosene, cooking fuel	23.3% 64/275	24.6% 29/118	35.2%45/128
Wood, cooking fuel	76.7% 211/275	72.0% 85/118	56.3%72/128
Exposure to heavy traffic	66.3% 185/279	55.7% 68/122	54.9% 78/142
Exposure to Pets	38.0% 106/279	39.3% 48/122	28.9% 41/142
Exposure to smoker at home	76.3% 213/279	79.5% 97/122	42.3% 60/142
Exposure to smoker at work/school	93.5% 261/279	41.0% 50/122	unavailable
Use of mosquito repellents	69.9% 195/279	68.0%83/122	41.5% 59/142
Diet, non-vegetarian food	100.0% 276/276	99.2% 119/120	99.2%127/128
Diet, Eggs	88.9% 248/279	80.3% 98/122	84.5% 120/142
Diet, Milk-buffalo	5.7% 9/159	5.5% 4/73	10.1% 11/109
Diet, Milk-cow	94.3% 150/159	94.5% 69/73	89.9%88/109

Table II lists certain factors that were taken into consideration as likely to bear an influence on the findings of this study. These factors may by themselves cause or may at least predispose as factors triggering hyper reactive airways disease.

Reflections

This research study clearly strengthens MAYA's observations and experiences of the detrimental effect of the sericulture industry on the health status of those working therein and in fact goes beyond to indicate the harmful influence of the general environment of the area. Certainly, there is a need for more extensive studies utilising a longitudinal design, detailed pulmonary function tests, serial monitoring and serum silk specific antigens to further study the problem and its influence not only on children but also the adults. Until then however, it is held that it would be prudent to initiate measures in protecting the working child population in filature units of the silk industry from continuing their exposure to allergens by releasing them from work and enrolling them to school. It is believed that in the years to come such exposure of children would be the cause of further respiratory morbidity often leading to disability and limited livelihood opportunities in adulthood.

Following this research study, MAYA's interactions with communities has also shown the declining trend of the sericulture industry and therefore its impact on the population of the region studied, in terms of high unemployment, indebtedness, migration to petty wage occupations, etc. Accordingly, it is believed that the need to explore alternate viable livelihood options for the adults in this area is critical and immediate; to counter the coupled effect of a health hazardous and declining industry.

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A sample of the Subject Information and Informed Consent form utilised for the research study

Subject Information Form

Study Title

A study of the Prevalence of hyper reactive airways disease in children working in the filature units in the sericulture industry and the effects in their general health.

You are (your child is) invited to take part in a study of the Prevalence of hyper reactive (Asthma) airways disease in children working in the filature units in the sericulture industry and the effects in their general health. Before agreeing to participate, it is important that you read and understand this form. If you are unable to read / understand the information, you can have an independent witness who will read it for you. This information form describes the purposes and procedures of the study. You are free to withdraw from the study at any time. Please ask the study investigator (doctor) or social worker to explain any portion of this form that you do not understand, you may ask any question related to the study.If you decide voluntarily to participate in the study, please sign the Informed Consent Form.

MAYA, Bangalore is supporting this study. Approximately 440 children (242 working in the filature units, 81 not working in the filature in units but living in the neighbourhood and 81 children from Malvalli will participate in the study.

The study will be co-ordinated by the Community Health Cell, Bangalore and carried out by the staff of the Paediatrics (Child Health) Department of St. John's Medical College Hospital, Bangalore, with the help of MAYA, Bangalore.

Study Procedures

Your medical history will be taken, including your daily food intake. You will be asked questions about any respiratory symptoms. A complete physical examination will be done (including height, weight, vital signs, examination of the various systems in the body, etc) to ascertain your health and state of nutrition. Your peak flow rate will be determined to bring out the functioning of your respiratory system. A skin test will be done by pricking the skin of the forearm. A small sample of your blood will be collected for examination of your blood.

Risk / Discomforts

When blood is drawn for laboratory tests, you may experience some pain. Some pain and swelling may be experienced from the skin test. If you experience any other symptom, please inform the doctor, social worker or others concerned immediately .

Possible benefits of taking part in the study.

The study and procedures will be provided at no cost to you. You may receive information about your health from the physical examination and the tests. The study is likely to provide on health information on the effects of working in the filature unit under the prevailing conditions.

Confidentiality

All information collected during this study is confidential, except as provided by the applicable laws and regulations. MAYA and its representatives, the investigators and ethics committee are entitled to review your medical files and the data, without violating the confidentiality. Your records will be identified only by your study number. The study report and study data may be published in reputed journals or used for other purposes, without revealing your identity. They may be given to the regulatory authorities, maintaining confidentiality.

Further information

If you need any further information, please contact

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Informed Consent

I have read or had read to me, information regarding the proposed. "A study of the Prevalence of hyper reactive airways disease in children working in the filature units in the sericulture industry and the effects in their general health, before signing this consent form, I have been offered ample opportunity to ask questions and have received answers that fully satisfy the questions. I know that I can withdraw from the study any time I wish. I hereby volunteer to take part in this study.

Name of subject Age: Signature of Subject: Date:

Name of parent Age: Signature of Parent Date:

(If subject/parent illiterate)
Name of witness Age: Signature of Witness Date:

Name of investigator Age: Signature of Investigator Date:

A discussion of the findings of this study in comparison with other studies conducted on this issue.

There have been few attempts to study occupational health status among sericulture workers (Harindranath et al [2]). Clinical survey of sericulture workers at Kollegal and Chikkaballapur led by PV Subbarao et al [6], and an Interns' project study in Kamagere village of Kollegal taluka by Ananthraman et al [7] are some of the documented studies available. However all these studies were done on adult workers. The uniqueness of the present study stems from the fact that it is a community-based occupational health study carried out on children working in filature units of sericulture industry.

Respiratory Morbidity

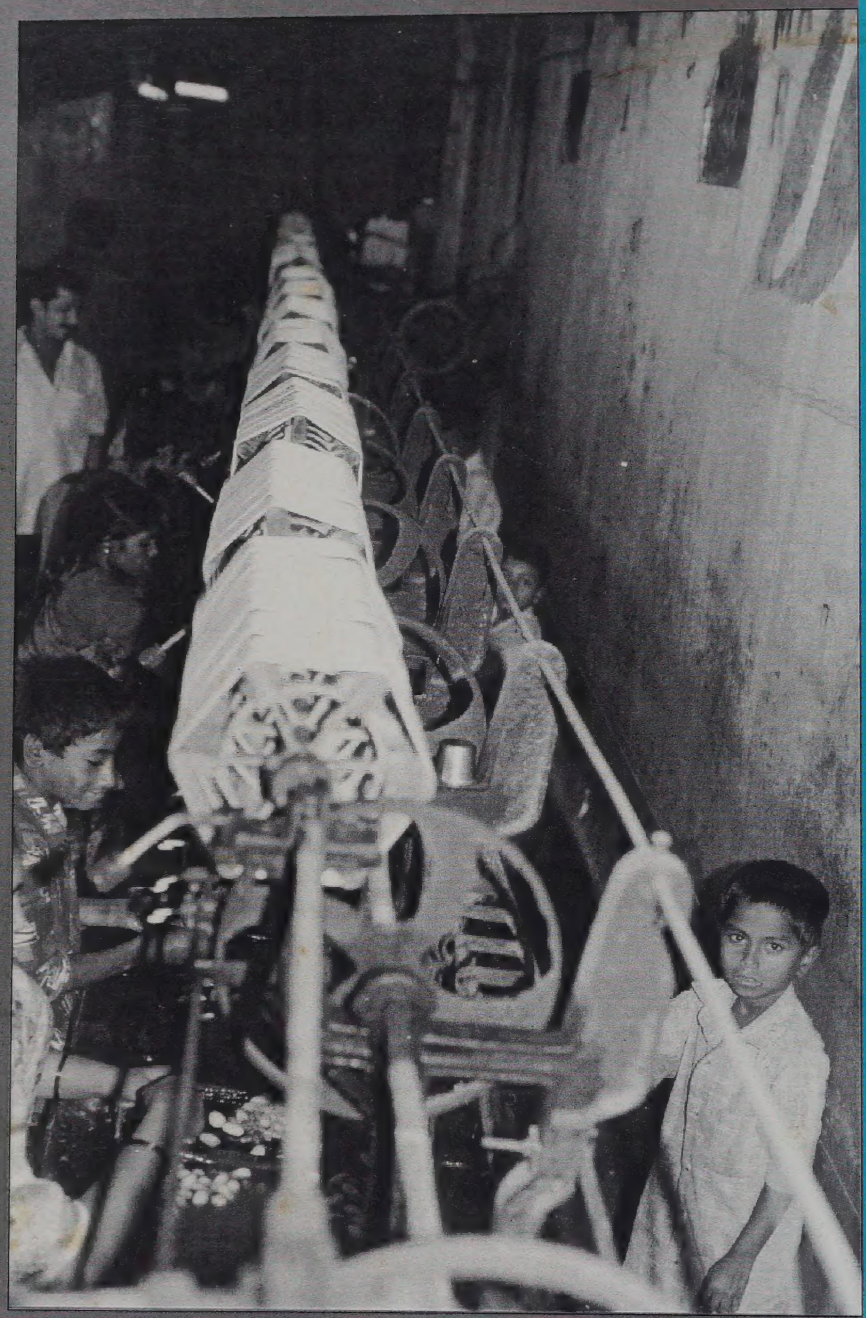
In comparison to this study, reported prevalence of respiratory morbidity in an intern's study conducted in Kamagere village in Kollegal district of Karnataka among reelers and non reelers, the prevalence of wheezing was 26%-8%, nocturnal cough 8%-4% and phlegm 22%-8% respectively. Except for wheezing none of the differences were statistically significant. Findings from the Harindranath et al study revealed that 36% of the workers in reeling units were suffering from asthma of varying severity.

Asthma

Most of the reported prevalence studies on asthma in children are generally studied among school children by administering questionnaires. The ISAAC study revealed an overall range for Indian cities a prevalence of 2%-18%. This study was restricted to age group of 13-14 years. Associated conditions in childhood asthma are allergic rhinitis 75%, serious otitis media 22.5% sinusitis 9% and eczema 8% [8]. Parmesh et al reported a study in the age group 6-15 years children a prevalence of asthma 16.6% in urban and 5.7% in rural children in Karnataka[3]. In comparison, Harindranath et al (Ann Allergy 1985) revealed that 36% of adult workers were suffering from asthma of varying severity. Parmesh (Pulm Pharmac Ther 2002) clearly states that urbanisation, air pollution and environmental tobacco smoke contribute to the increased prevalence of asthma among children.

Silk test

In the study reported by Harindranath et al silk antigen positivity was 21.8% of the persons employed in silk filatures responded skin prick test. 28% of the total subjects screened responded positively to either or both of the antigen.



MAYA is a Karnataka-based development and training organisation working, since the last 14 years, to address children's rights, with a specific focus on the eradication of child labour. Over the last 5 years, a significant thrust of the organisation's work has been on eradication of child labour in the sericulture industry of Karnataka.

This research study seeks to highlight the deleterious impact of the sericulture industry, particularly the silk reeling units, on the health not only of children working in these units but also on those living in the vicinity. The study is meant as a tool to draw attention to the imperative for addressing the issue of child labour in the sericulture industry. The findings of this study would be utilised to strengthen policy and practice vis-à-vis eradication of child labour in sericulture.

MAYA

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